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D E C I S I O N
of 25 July 1995

Case Number: T 0995/93 - 3.3.1

Application Number: 89901199.3

Publication Number: 0364511

IPC: C10M 173/00

Language of the proceedings: EN

Title of invention:
Water-in-oil emulsions

Applicant:
The Lubrizol Corporation

Opponent:
-

Headword:
Emulsions/LUBRIZOL

Relevant legal provisions:
EPC Art. 56

Keyword:
"Inventive step (no) - obvious alternative"

Decisions cited:
-

Catchword:
-

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Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number: T 0995/93 - 3.3.1

D E C I S I O N
of the Technical Board of Appeal 3.3.1
of 25 July 1995

Appellant: The Lubrizol Corporation
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Representative: Crisp, David Norman
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Decision under appeal: **Decision of the Examining Division of the European Patent Office of 25 May 1993, posted on 12 July 1993, refusing European patent application No. 89 901 199.3 pursuant to Article 97(1) EPC.**

Composition of the Board:

Chairman: A. J. Nuss
Members: J. M. Jonk
R. E. Teschemacher

Summary of Facts and Submissions

I. The Appellant (Applicant) lodged an appeal against the decision of the Examining Division on the refusal of the application No. 89 901 199.3 (international publication number WO 89/05848). The decision was based on Claims 1 to 7 filed on 4 May 1992, Claim 8 submitted on 25 May 1993, and Claims 9 and 10 filed on 13 November 1992, Claim 1 reading as follows:

"A water-in-oil emulsion comprising:

(A) a continuous oil phase;

(B) a discontinuous aqueous phase;

(C) a minor emulsifying amount of at least one salt derived from reacting component (C)(I) with component (C)(II) under salt-forming conditions, wherein component (C)(I) is at least one hydrocarbyl-substituted carboxylic acid or anhydride, or ester or amide derivative of said acid or anhydride, the hydrocarbyl substituent of (C)(I) having an average of from 20 to 500 carbon atoms, and component (C)(II) is at least one alkali or alkaline earth metal, and/or at least one alkali or alkaline earth metal compound; and

(D) a functional amount of at least one water-soluble, oil-insoluble functional additive dissolved in said aqueous phase; said functional additive being one or more oxygen-supplying salts, one or more non-oxidizing acids, or one or more borates, phosphates and/or molybdates."

II. The Examining Division held that the patent application did not meet the requirements of Article 56 EPC, having regard to the following documents:

(1) WO 87/03613 and
(2) US-A-3 269 946.

They considered that the closest state of the art with respect to the subject-matter of Claim 1 of the present patent application was the disclosure of document (1). The subject-matter of this Claim 1 differed from this state of the art only in that the salt-forming component (C)(II) was an alkali or alkaline earth metal or an alkali or alkaline earth metal compound instead of an amine. However, the replacement of an amine by the claimed salt forming components (C)(II) as alternatives, i.e without providing any improvement, was considered to be obvious to the skilled person in the light of document (2). This document, disclosing water-in-oil emulsions comprising emulsifying derivatives of a hydrocarbyl-substituted succinic acid or anhydride having at least about 50 aliphatic carbon atoms in the substituent, such as alkali metal salts, alkaline earth metal salts, hydroxy-alkyl amine salts, alkylene amine salts and the ammonium salt, showed that the salt-forming amines and alkali metal or alkaline earth metal compounds were interchangeable.

III. Oral proceedings were held in accordance with the provisions of Article 116(1) in conjunction with Rule 71(1) and (2) on 25 July 1995, which the Appellant, after having informed the Board accordingly, did not attend.

IV. In his written submissions, the Appellant argued that the skilled person would not have combined the teaching of document (2) with that of document (1), since he would have appreciated that the water-in-oil emulsions disclosed in document (1) containing water-soluble functional additives (D), owing to the undeterminable effects of such additives on the inherently instable emulsions, were not comparable. In support of this contention, he referred to document

(3) Kirk-Othmer, Encyclopedia of Chemical Technology, Vol. 8 (1979), pages 900 to 930.

Moreover, referring again to this document (3), he also contended that a skilled person seeking to provide an alternative emulsion system to that disclosed in document (1) might consider using an emulsifier having the same, or a very similar HLB (Hydrophile-Lipophile Balance) value to that of the amine salts disclosed in document (1). However, in view of the disclosure of document (3), he would appreciate that emulsifying amine salts and alkali metal salts have strongly different HLB values. Based on this teaching, the replacement of an amine with an alkali metal or alkaline earth metal as the salt-forming component of an emulsifier would definitely not be the first choice of a skilled person.

V. The Appellant requested in his notice of appeal that the decision under appeal be set aside and a patent granted on the basis of Claims 1 to 10 attached to the notice of appeal, i.e. the same claims as those which formed the basis for the decision of the Examining Division.

VI. At the conclusion of the oral proceedings, the Board's decision to dismiss the appeal was pronounced.

Reasons for the Decision

1. The appeal is admissible.

2. The subject-matter of present Claim 1 is based on Claims 1, 41, 39 and 38 of the patent application as filed.

Present Claim 2 is supported by the originally filed Claims 2 to 5.

Present Claim 3 is based on the originally filed Claims 9 and 10.

Present Claims 4 to 7 correspond to the respective Claims 11, 13, 15 and 22 of the originally filed patent application.

Present Claim 8 is supported by Claim 1 as filed, and page 29, lines 1 to 6, page 37, second and third paragraph, and page 25, second paragraph, of the specification of the originally filed patent application.

The subject-matter of Claim 9 is supported by page 18, last paragraph to page 19, first paragraph, Claim 26, and page 37, third paragraph.

Present Claim 10 corresponds to the originally filed Claim 42.

Thus, all claims of the present set of claims comply with the requirement of Article 123(2) EPC.

3. Pursuant to its powers under Article 114(1) EPC in appeals from the Examining Division, the Board has reached the conclusion that the subject-matter as defined in all the claims is new over the cited prior art. As this point was never at issue before the Examining Division, it is not necessary to give reasons for this finding.

4. This leaves the issue of whether the subject-matter of Claim 1 involves an inventive step.

4.1 The Board considers document (1) to be the closest state of the art. This document relates to water-in-oil emulsions which are useful as hydraulic fluids, explosives and acidising fluids comprising:

(A) a continuous oil phase;

(B) a discontinuous aqueous phase;

(C) a minor emulsifying amount of at least one salt derived from (C)(I) at least one hydrocarbyl-substituted carboxylic acid or anhydride, or ester or amide derivative of said acid or anhydride, the hydrocarbyl substituent of (C)(I) having an average of from 20 to 500 carbon atoms, and (C)(II) at least one amine (**including ammonia**); and

(D) a functional amount of at least one water-soluble, oil-insoluble functional additive dissolved in said aqueous phase; with the proviso that when component (D) is ammonium nitrate, component (C) is other than an ester/salt formed by the reaction of polyisobutenyl (Mn=950) substituted succinic anhydride with diethylethanolamine in a ratio of one equivalent of anhydride to one equivalent of amine

(cf. page 5, last paragraph, page 6, first paragraph, and page 45, lines 1 to 4 of the second paragraph).

In a preferred emulsion which is useful as a hydraulic fluid, the emulsifying component (C) is at least one amine salt of a C_{50-500}-polyisobutenyl succinic anhydride, and the functional additive (D) comprises at least one water-soluble, oil insoluble borate, phosphate and/or molybdate as rust inhibiting agents or anti-wear agents (cf. page 16, first paragraph, the paragraph bridging pages 17 and 18, page 56, lines 1 to 11 of the third paragraph, and the examples).

However, it was submitted by the Appellant that according to the claimed invention alternative water-in-oil emulsions were obtained (cf. the notice of appeal, page 3, third paragraph).

4.2 Therefore, in the light of this closest prior art, the Board sees the technical problem underlying the present patent application as being the provision of alternative water-in-oil emulsions to those disclosed in document (1).

The present patent application suggests, as the solution to this problem, a water-in-oil emulsion according to Claim 1, which comprises a minor emulsifying amount of at least one salt obtained by reacting under salt-forming conditions a compound defined under (C)(I) with an alkali metal or alkaline earth metal, and/or at least one alkali metal or alkaline earth metal compound.

It follows from the specification of the present patent application that according to the claimed invention water-in-oil emulsions are provided, which are, like the emulsions disclosed in document (1), suitable as hydraulic fluids, explosives and acidising fluids dependent upon the particular functional additives (D) employed (cf. page 49, last paragraph to page 50, line 4, of the present patent application, and page 10,

lines 1 to 7 of the last paragraph, page 11, the first four lines of the second paragraph, and page 11a, lines 1 to 3 of the second paragraph, of document (1)). Therefore, in the absence of any evidence to the contrary, the Board finds it credible that the technical problem as defined above has been solved.

4.3 It remains to be decided whether, in view of the technical problem to be solved, the requirement of inventive step is met by the claimed process.

4.4 As indicated above, document (1) relates to water-in-oil emulsions which are, for instance, useful as hydraulic fluids, comprising (C) at least one emulsifying amine salt of, preferably, a C_{50-500}-polyisobutenyl succinic anhydride, and (D) at least one water-soluble, oil-insoluble organic or inorganic acid or salt, such as a phosphate, borate and/or a molybdate functioning as a rust-inhibiting agent or an anti-wear agent when the emulsions are hydraulic fluids.

Suitable salt-forming amines for the preparation of the emulsifying component (C) include **ammonia**, **hydroxyalkyl amines**, such as mono-, di- and triethanol amine, and **alkylene amines**, such as ethylene diamine (cf. page 45, lines 1 to 4 of the second paragraph; page 47, second paragraph to page 51, first paragraph, particularly page 49, last paragraph; page 41, last paragraph to page 43, first paragraph, particularly page 42, second paragraph; and the examples).

Thus, document (1) being silent on emulsions comprising emulsifying alkali or alkaline earth metal salts of the acidic compounds indicated under (C)(I) does not give any pointer to the solution of the technical problem as defined above when considered in isolation.

4.5 However, document (2) concerns stable water-in-oil emulsions which are useful as lubricants and hydraulic fluids comprising an emulsifying derivative of a **hydrocarbon-substituted succinic acid having at least about 50 aliphatic carbon atoms in the substituent**, typically a **polyisobutenyl succinic anhydride**, said derivative being selected from (I) **alkali metal salts**, (II) **alkaline earth metal salts**, (III) esters of hydroxy-alkyl amines, and (IV) amides, imides, amidines, and **salts of ammonia**, **hydroxyalkyl amines**, and **alkylene amines** (cf. column 1, lines 13 to 49, column 8, lines 6 to 8, and the examples).

Suitable salt-forming compounds for the preparation of the emulsifying derivatives are diethanol amine, triethanol amine, ethylene amine, ammonia, potassium hydroxide, barium hydroxide and calcium oxide (cf. Examples A, B, C, D, K, L, and M respectively).

Therefore, the water-in-oil emulsions disclosed in document (2) can be used for the same purpose as those of document (1) and also can contain the same emulsifiers such as the ammonium salt, or a hydroxyalkyl or an alkylene amine salt of a polyisobutenyl succinic anhydride. In these circumstances it is the Board's position that a skilled person would consider the emulsions described in document (2) to be emulsions of the same type as those described in document (1). Furthermore, document (2) also teaches that in such emulsions the emulsifying ammonium and amine salts can be replaced by the corresponding alkali metal and alkaline earth metal salts.

4.6 Thus, a skilled person faced with the problem of providing alternative water-in-oil emulsions to the emulsion systems disclosed in document (1), in the Board's judgment, would have taken the technical

teaching of document (2) as a promising means of resolving it, i.e. the provision of a water-in-oil emulsion according to present Claim 1, which comprises a minor emulsifying amount of at least one salt obtained by reacting under salt-forming conditions a compound defined under (C)(I) with an alkali metal or alkaline earth metal, and/or at least one alkali metal or alkaline earth metal compound (instead of an amine or ammonia).

4.7 It is true that - as submitted by the Appellant - document (2) does not disclose water-in-oil emulsions comprising **water-soluble, oil-insoluble additives (D)** as defined in document (1) (cf. document (1), particularly page 56, last paragraph to page 58, third paragraph), and that the presence of such additives could be expected to have unpredictable effects on the stability of the emulsions.

However, it is indicated in document (2) that the properties of the emulsions described therein might even be improved by the incorporation of chemical additives, such as emulsion stabilisers, extreme pressure agents (e.g. phosphates), rust-inhibiting agents, foam-inhibitors, freezing point depressants, bactericides (e.g. borates) and oxidation-inhibitors (cf. column 8, line 19 to column 11, line 61, particularly column 9, lines 70 to 74, column 10, lines 33 to 50, and column 11, lines 48 to 53).

Therefore, in the Board's judgment, a skilled person would still have concluded that the water-in-oil emulsions described in document (2) were comparable with those disclosed in document (1). In this context, it is

observed by the Board that the teaching of document (2) does not comprise any requirement or restriction concerning the water- or oil-solubility of the functional additives which impart properties desired for the various applications.

Thus, contrary to the Appellant's view, a skilled person looking for alternative emulsifiers to those described in document (1), in the Board's view, would not have hesitated to combine the teaching of document (2) with that of document (1).

4.8 The Board does not accept the Appellant's submission that a skilled person, in view of the disclosure of document (3) indicating that emulsifying alkali metal salts and amine salts have very different HLB values, would also not have considered emulsifying alkali metal or alkaline earth metal salts to be proper alternatives to corresponding amine salts.

Document (3) (cf. page 910, first line to page 918, first paragraph) discloses

(a) that the HLB value of an emulsifier determines the type of an emulsion that tends to be formed and that emulsifiers with low HLB values (strongly lipophilic) tend to make water-in-oil emulsions (cf. page 910, the first two paragraphs),

(b) that suitable emulsifiers for a particular emulsion should have HLB values as close as possible to the so-called required HLB (cf. page 912, fourth paragraph, and the paragraph bridging pages 916 and 917),

(c) that the so-called required HLB can be related to emulsification, stability, ease of emulsification, wetting, dispersing, foaming, or any desired property, and that the optimum for different

functions does not necessarily occur at the same HLB but can vary depending upon the nature of the emulsifier and the ingredients (cf. page 912, under *HLB Values*), and

(d) that the HLB system reduces but does not eliminate the trial and error in emulsifier selection (cf. page 917, sixth paragraph).

Moreover, as submitted by the Appellant, it follows from Table 4 of document (3) that triethanolamine oleate soap has a different HLB value (12) compared with sodium oleate (18) and potassium oleate (20).

However, in view of the teaching of document (3) as indicated under points (b), (c) and (d) above that the so-called required HLB and, therefore, the choice of a proper emulsifier depend upon the nature of the ingredients and the emulsifier, this document, in the Board's judgment, does not teach that suitable emulsifiers must necessarily have the same or **very** similar HLB values as suggested by the Appellant (cf. the statement of grounds of appeal, page 5, second paragraph, first sentence, and page 6, third paragraph, last sentence).

Moreover, having regard to the quite different structure of oleates compared with the emulsifiers disclosed in documents (1) and (2) which are derivatives of substituted succinic acid or anhydride, in which the substituent - as indicated above - is a strongly lipophilic group, preferably a C_{50-500}-polyisobutenyl group, the specific information in document (3) with respect to the HLB values of the triethanolamine oleate soap and the two alkali metal oleates, in the Board's judgment, does not provide sufficient evidence to

support the Appellant's allegation that the replacement of an amine salt described in document (1) by a corresponding alkali metal or alkaline earth metal salt would definitely not be the first choice of a skilled person.

4.9 It follows that the subject-matter of present Claim 1 lacks inventive step and, thus, does not comply with Article 56 EPC.

4.10 The dependent Claims 2 to 10 fall with Claim 1.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

E. Görgmaier A. J. Nuss